

WHAT IS CLAIMED IS:

1. A vibrator apparatus for connection to a well tubular member for imparting longitudinal vibrations thereto, said vibrator apparatus comprising:

5 a vibrator section including a member adapted to be connected to an elongated well tubular member for transferring vibrations thereto; and

a support section interposed said vibrator section and a wellhead structure for supporting said apparatus on said wellhead structure, said support section including  
10 pressure fluid support and isolation members operably supporting said vibrator section.

2. The apparatus set forth in Claim 1 wherein:

said pressure fluid isolation members comprise pressure fluid cylinder and piston assemblies for absorbing longitudinal vibrations reacted by said vibrator section and  
5 for elevating said vibrator section with respect to said wellhead structure.

3. The apparatus set forth in Claim 2 wherein:

said support section includes a flange for mounting said vibrator apparatus on said wellhead structure, a support plate connected to said flange and supporting said  
5 cylinder assemblies and said vibrator section includes a frame supported by said cylinder assemblies.

4. The apparatus set forth in Claim 3 wherein:  
said support section includes an array of four pressure fluid cylinder and piston assemblies mounted on said support plate and arranged in a substantially symmetrical pattern with respect to a central axis of said apparatus, said axis being substantially coincident with a longitudinal central axis of said tubular member.

5. The apparatus set forth in Claim 1 wherein:  
said vibrator section includes a frame including opposed end walls and intermediate walls supporting spaced apart bearing assemblies, spaced apart, substantially parallel rotatable shaft members mounted in said bearing assemblies, respective eccentric weights mounted on said shafts, respectively, and a timing mechanism interconnecting said shafts for rotating said shafts in synchronization with each other to cause said weights to impart longitudinal vibratory forces on said tubular member.

6. The apparatus set forth in Claim 5 wherein:  
said shafts each support plural eccentric weights thereon and spaced apart substantially equidistant from a longitudinal central axis of said apparatus and which is substantially coincident with a central axis of said tubular member.

7. The apparatus set forth in Claim 5 wherein:  
said timing mechanism comprises gears mounted on said shafts, respectively, and meshed with each other to provide timed rotational movement of said shafts.

8. The apparatus set forth in Claim 5 wherein:  
said eccentric weights are supported on said  
shafts by removable clamp members whereby said eccentric  
weights may be exchanged for eccentric weights of different  
5 mass value.

9. The apparatus set forth in Claim 5 wherein:  
said frame includes a part operably connected to  
said pressure fluid support and isolation members of said  
support section, a top wall and opposed side walls forming  
5 an enclosure and at least a portion of said enclosure  
provides a chamber for said timing mechanism.

10. The apparatus set forth in Claim 1 wherein:  
said pressure fluid support and isolation members  
comprise plural cylinder assemblies and said apparatus  
includes a fluid flow circuit including a pump for supplying  
5 pressure fluid to said cylinder assemblies, respectively.

11. The apparatus set forth in Claim 10 including:  
a manifold for distributing pressure fluid to and  
receiving fluid from respective ones of said cylinder  
assemblies, and flow control devices interposed said  
5 cylinder assemblies and said manifold for effectively  
causing fluid flow through said cylinder assemblies during  
operation of said apparatus.

12. The apparatus set forth in Claim 11 wherein:  
said fluid flow circuit comprises a hydraulic  
fluid flow circuit including hydraulic accumulator means  
operably connected in circuit with said manifold for damping  
5 pressure and flow fluctuations in said hydraulic fluid flow  
circuit.

13. The apparatus set forth in Claim 12 wherein:  
said hydraulic fluid flow circuit includes plural  
accumulators connected in parallel for absorbing said  
pressure and flow fluctuations, respectively.

14. The apparatus set forth in Claim 1 including:  
pressure fluid drive motors operably connected to  
spaced apart rotatable shafts on said vibrator section,  
respectively, for rotatably driving said shafts to induce  
5 longitudinal vibratory forces imposed on said tubular  
member.

15. The apparatus set forth in Claim 1 including:  
means for supporting said tubular member on said  
vibrator section for rotation with respect to said vibrator  
section.

16. The apparatus set forth in Claim 15 wherein:  
said means for supporting said tubular member for  
rotation comprises a bearing support member, a bearing  
assembly supported by said bearing support member and a  
5 member engaged with said bearing assembly for supporting  
said tubular member with respect to said vibrator apparatus  
for rotation with respect to said vibrator apparatus.

17. The apparatus set forth in Claim 16 including:  
means for connecting said member supported on said  
bearing assembly to said bearing support member for  
retaining said tubular member non-rotatable with respect to  
5 said vibrator apparatus.

18. The apparatus set forth in Claim 1 including:  
means engageable with said tubular member for  
rotatably driving said tubular member with respect to said  
vibrator section while vibrations are imposed on said  
5 tubular member by said apparatus.

19. A vibrator apparatus for connection to a well  
tubular member for imparting longitudinal vibrations  
thereto, said vibrator apparatus comprising:

a vibrator section including a member adapted to  
5 be connected to an elongated well tubular member for  
transferring vibrations thereto;

a support section interposed said vibrator section  
and a wellhead structure for supporting said apparatus on  
said wellhead structure, said support section including an  
10 array of plural pressure fluid cylinder assemblies mounted  
on said support section and arranged in a substantially  
symmetrical pattern with respect to a longitudinal axis of  
said tubing or casing member; and

a pressure fluid circuit including a pump and a  
15 manifold for receiving pressure fluid from said pump for  
distributing pressure fluid to respective ones of said  
cylinder assemblies and for receiving pressure fluid from  
said cylinder assemblies, respectively.

20. The apparatus set forth in Claim 19 including:  
flow control devices interposed said cylinder  
assemblies and said manifold for effectively causing fluid  
flow through said cylinder assemblies during operation of  
5 said apparatus.

21. The apparatus set forth in Claim 19 including:  
pressure fluid accumulator means operably in  
circuit with said manifold for damping pressure and flow  
fluctuations in said circuit and generated by said cylinder  
5 assemblies.

22. The apparatus set forth in Claim 21 wherein:  
said circuit includes plural accumulators disposed  
in parallel in said circuit for absorbing said pressure and  
flow fluctuations, respectively.

23. The apparatus set forth in Claim 19 including:  
pressure fluid drive motors operably connected to  
respective rotatable shafts, respectively, for rotatably  
driving said shafts to induce longitudinal vibratory forces  
5 imposed on said tubing or casing member.

24. The apparatus set forth in Claim 19 including:  
means for supporting said tubular member on said  
vibrator section for rotation with respect to said vibrator  
section.

25. The apparatus set forth in Claim 24 wherein:

5       said means for supporting said tubular member for rotation comprises a bearing support member, a bearing assembly supported by said bearing support member and a member engaged with said bearing assembly for supporting said tubular member with respect to said vibrator section for rotation with respect to said vibrator section.

26. A vibrator apparatus for connection to a well tubular member for imparting longitudinal vibrations thereto, said vibrator apparatus comprising:

5       a vibrator section including a member adapted to be connected to an elongated well tubular member for transferring vibrations thereto;

10       a support section interposed said vibrator section and a wellhead structure for supporting said apparatus on said wellhead structure, said support section including an array of plural pressure fluid cylinder assemblies mounted on said support section;

15       a pressure fluid circuit including a pump and a manifold for receiving pressure fluid from said pump for distributing pressure fluid to respective ones of said cylinder assemblies;

      flow control devices interposed said cylinder assemblies and said manifold for effectively causing fluid flow through said cylinder assemblies during operation of said apparatus; and

20       plural accumulators disposed in parallel communication with said circuit for damping at least one of pressure and flow fluctuations in said circuit.